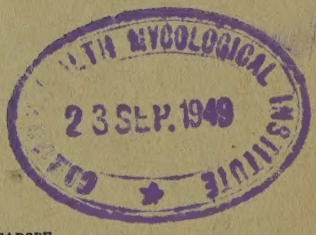
COLONY OF SINGAPORE

BOTANIC GARDENS DEPARTMENT ANNUAL REPORT FOR 1948

BY

R. E. HOLTTUM, M.A., F.L.S.,
Director of Gardens, Singapore.



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Introductory.

Shortly after the founding of Singapore, Raffles established a Botanic Garden on the slopes of Fort Canning, towards Stamford Road, but this Garden was abandoned in 1829. The present Botanic Gardens date from 1859, and were started by an Agri-horticultural Society formed for the purpose. The Society continued to maintain the Gardens until 1874, when they were handed over to the Government.

Until the formation of the Malayan Departments of Forestry and Agriculture at Kuala Lumpur about 1905, the Singapore Botanic Gardens was the only centre of research on Forestry and Agriculture in Malaya, and there were subsidiary stations at Penang and Malacca. The Superintendent of the Gardens made the first report on the Forests of the Straits Settlements in 1882, as a result of which Forest Reserves were established under his control. The Economic Garden, established in 1879 on land adjacent to the Botanic Gardens and now occupied by Raffles College, was used for experimental planting of many newly introduced useful plants, among them the first Para rubber trees, brought to Singapore in 1878. The early tapping experiments were carried out in the Economic Garden under Mr. H. N. Ridley, and from the trees in the Economic Garden seeds were supplied for planting many rubber estates in Malaya.

Along with this pioneer work of immediate economic importance, the Botanic Gardens has throughout been a centre for the study of the native Flora of Malaya. Botanical exploration began in the eighteen seventies, and has resulted in the formation of a very large collection of herbarium specimens (mainly dried) and drawings. Many local species have also been cultivated in the Gardens and studied in the living state. Along with the building up of a herbarium, a botanical library has also been gradually established, containing most of the important books and periodicals dealing with the plants of S. E. Asia. Based on this material, Mr. H. N. Ridley prepared a Flora of the Malay Peninsula, published 1922-25.

In recent years the Botanic Gardens have been concerned with the more decorative side of horticulture, experimental introduction of new plants, with plant breeding, and with a continued study of the Malayan Flora. These are all interdependent activities. Fortunately our herbarium and library survived the war intact. The Botanic Gardens also has control of three areas of natural vegetation in Singapore island which are maintained as Nature Reserves.

Botanical Work in 1948.

The principal object of the botanical work of the Department is the preparation of a revised Flora of the Malay Peninsula. Mr. Ridley's Flora, published 1922-25, is now much out of date, and is also difficult to understand unless one has access to the Singapore herbarium on which it is based. That Flora contains descriptions of over 6,000 species of higher plants (not including ferns). Probably present collections will show an increase to about 7,000 but still every new collection of any size includes species not known to exist in Malaya previously, and our knowledge of many others is derived from single specimens only. It is thus impossible even now to prepare a complete account of the Flora, but it is possible to prepare an up-to-date account which is intelligible to the non-specialist, and this is our aim. To prepare such a Flora one must study also records and specimens of plants in neighbouring countries, as many of our species are not confined to Malaya; and it may be

desirable to prepare monographs of groups of allied species including some which occur outside Malaya. A Flora also should have illustrations, and these must be accurately drawn by a trained artist under expert supervision. All this work is complex and cannot be hurried; to complete it will take several years.

During the period of Japanese occupation, the Director studied several plant families and prepared new descriptions of all species in them. During the year 1948 the copying and revision of these manuscripts was completed. The families are: ferns, orchids, grasses, sedges (Cyperaceae) and gingers (Zingiberaceae). Every opportunity was taken to check the manuscript by examination of fresh specimens of plants of these families, and a few additions were made during 1948. It is hoped to keep these manuscripts up-to-date in this way pending the possibility of publication.

The Director also carried out further studies of bamboos, and made a preliminary study of the Pandans of Malaya. A short field expedition was made in February to Ulu Langat, Ginting Simpah, and the Cameron Highlands road, to study bamboos in the foot-hills of the main range, and some useful new data obtained. Much more field study of bamboos in the north of Malaya is necessary, as the number of kinds in the north is much greater than in the south, and the discrimination of allied species is often difficult. As regards Pandans, there are some forty species in Malaya, including several which have never been described, and the establishment of characters by which they can be distinguished when not flowering or fruiting needs more study. Some of them fruit rarely, and the male flowers of some are quite unknown.

Mr. M. R. Henderson, Assistant Director, was absent on leave from March to October, 1948. His work on the genus Eugenia in Malaya was sent to press and is to appear in the Gardens' Bulletin in 1949. Mr. Henderson made provisional revisions of the families Dilleniaceae and Magnoliaceae in Malaya, but as specialists were also engaged on these families for the larger area covered by *Flora Malesiana*, the manuscripts were sent on to these authors for use in connection with their work.

Mr. Henderson spent a considerable amount of time working on a popular book on Malayan Wild Flowers, illustrated with line drawings, which is being printed in parts in the Malayan Nature Journal. The work is an attempt to describe the commoner small plants of Malaya, for the benefit of the reader who is not a botanist and who wishes to know the names and relationships of the plants he may see in villages and at hill stations.

Mr. J. Sinclair, Curator of the herbarium, arrived to assume duty on 1st May, 1948. Mr. Sinclair immediately began a revision of the family Annonaceae for the Flora, and at the end of the year had nearly completed this work so far as present collections permit. He also carried on the usual routine work of the herbarium, identifying specimens from the Conservator of Forests in North Borneo, the Department of Agriculture, Kuala Lumpur, the Rubber Research Institute of Malaya, and other institutions and persons. Mr. Sinclair carried out a considerable amount of field work in Singapore island, collecting specimens for exchange purposes and also adding data for our own herbarium. Both coloured and line drawings were prepared by the artist of all Annonaceae found in flower and fruit in Singapore during this work.

Dr. C. X. Furtado, Assistant Botanist, continued his work on Malayan palms, and completed an account of the genus Calamus in Malaya (about 75 species). These include the great majority of the useful rattan canes of Malaya. Dr. Furtado also continued his study of the complex problems of botanical nomenclature and prepared a further paper on the subject.

The artist worked continuously throughout the year, making drawings in line and in colour of plants of both botanical and horticultural interest. Mrs. D. Kinloch Smith also presented to the Gardens a fine series of coloured drawings she has made from flowers cultivated in the Gardens.

The Herbarium.

Steady progress was made with mounting of specimens, and 4,452 sheets were added to the herbarium during the year. A total of 3,095 specimens were despatched on an exchange basis to herbaria at Leiden, Manila, Calcutta, Edinburgh, Lisbon and Paris. Receipts of specimens amounted to 3,486, from Paris, North Borneo (Forest Department), Leiden, Brisbane, Auckland, and Dehra Dun (Forest Research Institute). 524 specimens were sent on loan for study, chiefly in connection with the *Flora Malesiana* scheme, to Kew, the British Museum (Natural History), and Zurich.

The Hong Kong herbarium, which was sent to Penang for safe keeping in 1940, brought to Singapore by the Japanese, and then incorporated in the Singapore herbarium for greater safety, was returned intact to Hong Kong in 1948. In the meantime it had been useful for various studies in Singapore. The building in which it had been housed in Hong Kong was destroyed during the war.

Publications.

Vol. XI, part 4, of the *Gardens' Bulletin* was published in October, 1947. Material for further parts is ready but printing was not possible during 1948. The *Gardens' Bulletin* contains descriptions of new species and other detailed and critical matter not suitable for publication as part of a Flora; such publication is an essential preliminary to the preparation of more general works. The *Bulletin* is exchanged with similar publications from other botanical institutions and so is valauble in building the Gardens' library. The Director published a critical review of the Classification of the family Cyperaceae in *The Botanical Review* (New York).

As regards major publications, a reprint of Corner's *Wayside Trees of Malaya* is the most urgent necessity, as this work is very useful as a general introduction to the study of Malayan plants. It is hoped that reprints of *Wayside Trees* will be followed by publication of the works on orchids, ferns etc. which have now been prepared.

Roads, Buildings, Etc.

The main roads in the southern part of the Gardens were re-laid and surfaced by the Public Works Department, and the drains also renewed. The roads in the northern half remain to be dealt with. Traffic is at present restricted to the newly made roads, which allow plenty of space for parking of cars; this also leaves the other roads free for visitors to walk without interference from traffic. The number of visitors is now far greater than before the war, especially at week-ends.

The Public Works Department also removed a great deal of silt from the upper part of the lake, which was deepened to three feet. The resulting damage to the adjacent lawns and paths was not made good by the end of the year.

The plant houses for display of pot plants, orchids etc, have still not been rehabilitated. One house for propagating pot plants was re-roofed, and one temporary house for orchid seedlings built, but our requirements of roofed houses for protecting seedlings and young pot plants from torrential rains are still far short of our needs.

Horticultural Work: Botanic Gardens.

During the year the Botanic Gardens were brought back to about their pre-war standard of maintenance, and nursery stocks also were increased so that rooted plants of all the most useful kinds were available for sale to the public. In all 6,885 plants were sold, and the revenue obtained was $5,348.

The plans showing woody plants on the various lawns throughout the Gardens, and the card-index of these plants, were checked and kept up-to-date. Over 700 wooden or metal painted labels were made, and also a large quantity of tie-on aluminium labels.

Canna beds were re-made and planted all along the road from the main gate to the lake, restoring the pre-war appearance of this area. The beds were closed during the Japanese occupation owing to a disease which killed most of the Cannas.

The area containing the bamboo collection, which had become much overgrown, was thoroughly cleared and brought into a condition to be mown regularly. The bamboo collections were increased by addition of some new kinds brought in for study by the Director.

New trees and shrubs were planted in various places, but this work has not yet reached the extent it should attain. One reason is the great labour necessary for digging our heavy clay soil, and the large amount of compost needed, when new trees are planted.

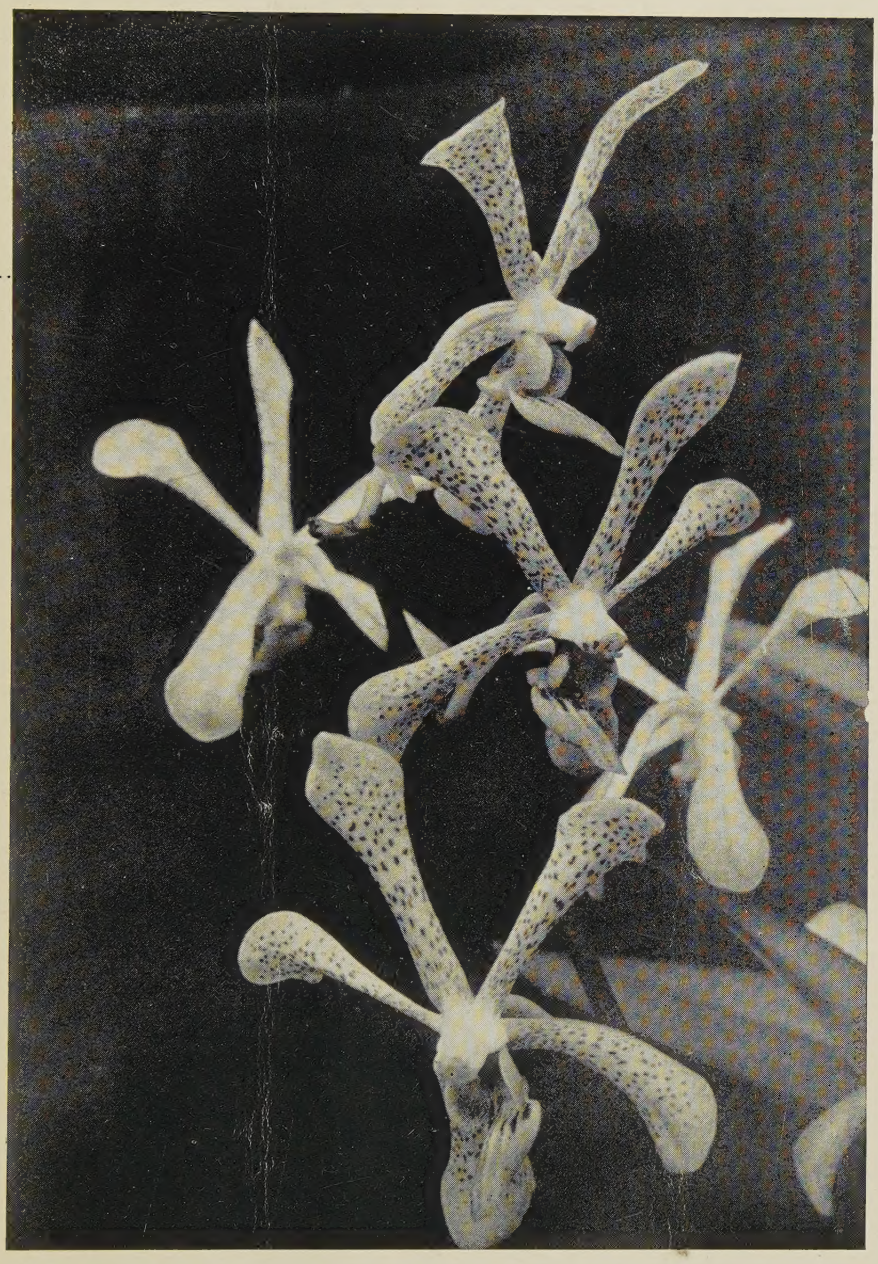
The area on lawn R devoted to smaller plants of economic value (a vegetable garden during the war) has been fenced, and various plants have been added including Vanilla and Cocoa. It is intended to increase the collection in this area as opportunity offers.

Succulents. An effort has been made to increase the number of succulent plants. Some thirty different species of Cereus, Aloe, Gasteria and Haworthia were received as a gift from Kew, and other plants were raised from seeds from Kirstenbosch (Cape), the U.S.A., Cuba and Lisbon. Several of these flowered during the year, notably two very curious species of Stapelia (*S. variegata* and *S. Wilmaniae*) from South Africa. The larger cacti are in cultivation in a sun rockery on lawn E, and some have been added to this area during the year. A large old plant of *Cereus peruvianus* flowered and fruited several times, and a large number of seedlings were raised from it. Some of them were used as stocks for grafting the less wet-resistant kinds of Cereus, and it is hoped that the grafted plants will now stand cultivation in the open. Three such grafted plants have already been planted as a trial. A surprising range of succulents can be grown in Singapore if they are protected from heavy rain, suitably potted and given no more water than they need, but a good many will not flower in our humid atmosphere.

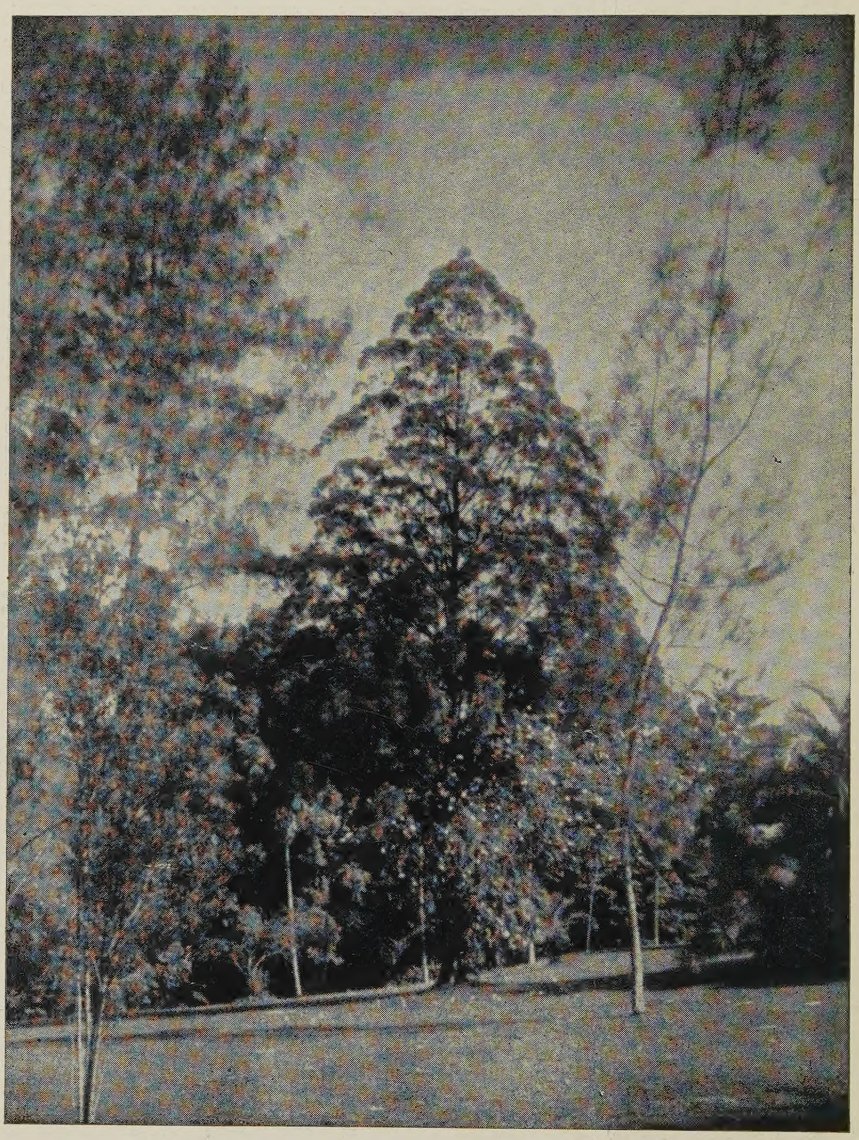
Pot plants. The display of flowering pot plants was maintained as in previous years. Some new varieties of Coleus were grown. The Hydrangeas were particularly good. The foliage pot plants in the plant house were also maintained, and there was considerable improvement in the standard of the Anthuriums. A few fine new Anthuriums were presented by the Bangkrabue nursery, Bangkok, and it is hoped to breed more new varieties from these by crossing.

Orchids. The experimental production of hybrid orchids was begun in a small way in 1930, and has continued since. The object of the work is to produce a variety of fine new orchids which will flower well in the lowland climate of Malaya, as few such orchids are provided by nature and by orchid breeders in other countries. The process is slow and has many difficulties.

Orchid seeds are small, and must be grown on agar-agar in sterile culture, and the step of transference of seedlings from culture flask to the open air is a critical one. During 1948 a considerable advance in this last matter was made,



A free-flowering hybrid orchid raised at the Botanic Gardens, Singapore: Aranda Hilda Galistan.



Casuarina trees on lawn C; *C. equisetifolia* on left (Malayan), *C. sumatrana* in centre, *C. glauca* on right (Australian).

Arachnis–Vanda hybrids raised from seed at Singapore.

Young seedling orchid plants; the pots are embedded in coir dust.

by the use of coir dust as a medium in which to plant the newly transferred small seedlings. Coir dust is light and holds a great deal of moisture without becoming sodden; it therefore maintains the constant moist conditions which the orchid seedlings need, and at the same time is well aerated. Furthermore, it is free from moulds, and rots very slowly. The pots of all small seedlings also are plunged into a deep bed of coir dust, which maintains a cool humid atmosphere all around; for this purpose it is probably better than a free water surface.

The kinds of orchids most useful for the lowlands of Malaya are the scorpion orchids (Arachnis), the Vandas (especially terete Vandas), the red-flowered Renantheras, Dendrobiums of the section Ceratobium from Eastern Malaysia, and the Malayan terrestrial genus Spathoglottis. Vanda, Arachnis and Renanthera are particularly useful because they are very easy to propagate and stand full sun; they may therefore be grown in any garden, only needing a supporting post with a good layer of compost around the base. The only wild orchid of this alliance which is really strong and free-flowering in Singapore is the white scorpion orchid, *Arachnis Hookeriana* (also called *A. alba*), but a number of hybrids produced from this, and also from terete Vandas, by crossing with a variety of related species, have proved very free-flowering. The intention is to increase the number of these, and many hundreds of new seedlings are now at various stages of development. It is necessary to raise a large number of seedlings to secure the maximum possible variation, and so increase the chance of producing a few really good novelties. For success, a plant must be strong, free-flowering, and have large flowers of good form and distinctive colour, and among hybrids of the second and third generation only a small minority may have all these desirable features.

The following free-flowering hybrids have now been produced, and are being propagated from cuttings:

Arachnis Maggie Oei (A. flos-aeris x A. Hookeriana var. luteola)
Arachnis Ishbel (A. Hookeriana x Maingayi)
Arachnis Catherine (A. Hookeriana var. luteola x Sulingi)
Aranda Deborah (A. Hookeriana x V. lamellata)
Aranda Hilda Galistan (A. Hookeriana x V. suavis)
Aranda Nancy (A. Hookeriana x V. Dearei)
Aranda Mei Ling (A. Hookeriana x V. sumatrana)
Vanda Cooperi var. Cho Yam Neo (V. Miss Joaquim x Hookeriana)
Vanda Mme. E. M. E. Dinger, a selected variety (V. Miss Joaquim x tricolor)
Vanda Amy (V. Hookeriana x tricuspidata)
Vanda Nam Kee (V. Cooperi x Marguerite Maron)
Aranthera Mohamed Haniff (Arachnis Hookeriana x Renanthera coccinea).

Pure white Vanda hybrids have been produced by the use of a white variety of *V. Hookeriana*, but the plants are not strong. A further crossing with a large white *V. teres* has been made.

Plants of the genus Dendrobium cannot be grown in beds like Vandas, are slower to propagate and require more careful handling. The flowers however are very beautiful and durable, and the hybrids are mostly stronger and more free-flowering in Singapore than their parents.

Good progress was made in methods of cultivation of Dendrobiums during the year. There is no doubt that, when the plants are properly established in pots, intensive manuring may be practised, and that plants so manured will attain a much larger size than without such treatment. Intensive manuring seems to have no deterrent effect on flowering. In other countries manuring of orchids has been considered unnecessary, but it is certainly necessary for best results in Malaya.

Spathoglottis hybrids have combined the characters of yellow-flowered mountain species and purple lowland species. First generation hybrids are almost sterile, but one second generation hybrid has proved fertile and a large number of seedlings were raised from seed planted in October 1946. The first of these flowered towards the end of 1948, and included one of outstanding merit, with a good head of entirely pale creamy yellow flowers.

Seed Exchange. A seed exchange list was printed during the year and distributed to all Botanic Gardens which have sent us their lists. As a result there have been very numerous requests for seeds, and 967 packets have been sent out, to Gardens in all parts of the world. Seeds received in exchange amounted to 272 packets.

Government House Domain, Singapore.

The main areas of grass were maintained in good order by the use of motor mowers. An Allen motor scythe was purchased and with this the areas of lallang have been kept under control; it is hoped to bring much of this ground into a condition to be cut by an ordinary motor mower. A Hibiscus hedge 75 yards long was planted to separate the upper and lower parts of the Domain.

Further flower beds were made in front of Government House, and a number of new trees and shrubs planted. The *Bauhinia kockiana* plant gave a particularly fine display of flowers from August to December (this is a native Malayan climber with orange flowers).

The nurseries for flowering pot plants, cut flowers, and vegetables were maintained. Pot plants were changed twice a week. Some good new varieties of Dahlia have been introduced.

Other Work Outside Botanic Gardens.

Advice was given to the Public Works Department on the planting of trees and hedges at the St. George's Road quarters. Advice was given regarding the trees in the compound of St. Andrew's Cathedral, a new planting scheme was prepared, and the work of removing old trees and making new planting holes was supervised. Advice was also given about planting of trees, shrubs etc, at Social Welfare Department centres, at the residence of the Admiral, at R.A.F. stations and elsewhere, also to many individuals who enquired personally at the Gardens Office. Contact was maintained with the Municipal Parks Department throughout the year and advice given from time to time as requested.

The Botanical Reserves.

In 1937 the Forest Reserves in Singapore island (largely mangrove) were considered to be no longer worth maintaining for their production of timber. Parts of three Reserves were then handed over to the Botanic Gardens Department for maintenance as representative areas of natural vegetation. The areas retained the status of Forest Reserves for purposes of administration, but they have since been in effect Nature Reserves, primarily maintained for their botanical interest.

The three areas are: (1) a small area of mangrove adjacent to the 14th mile on the Woodlands Road: (2) a larger area of mangrove between the Pandan and Jurong rivers: (3) Bukit Timah Forest Reserve.

The Woodlands Reserve was formerly cleared of all but quite young trees. These trees have grown well in the past ten years, and other regeneration has also been satisfactory. The interesting species *Pandanus Corneri* is well represented; it probably now occurs nowhere else in the island. Two men

patrol the Reserve, and have maintained a path all round it. The path is in part a raised bank, and includes plank bridges. Re-making of part of the path was completed during 1948.

The Pandan Reserve also was almost entirely cleared of large trees in 1937. The regeneration in the past ten years has been satisfactory, and the effect of some re-planting (from seed) made in 1939-40 is now apparent. The Reserve contains all the characteristic plants of mangrove, and also is big enough to give shelter to an interesting natural fauna. Our thanks are due to Mr. Choa Ho Ann, who has taken a considerable interest in the Reserve from its establishment, and to him the present satisfactory condition of the trees is largely due.

The Bukit Timah Reserve includes all the remaining forest on the upper slopes of the hill, which is the largest in Singapore island (567 ft.) except the slopes in the water catchment area which adjoins the Reserve. The total area now reserved is about 200 acres. It includes a fine sample of primitive forest, with a great variety of trees and smaller plants, some of which certainly do not now occur elsewhere in the island.

Before 1941 a number of paths were made in the Reserve, to give access to all parts of it, and also a boundary path. The Reserve is regularly patrolled, and cutting of timber is now negligible. Areas which had been devastated in 1936–37 have regenerated well and now carry dense thickets of young trees. The Japanese fortunately did not do much damage in the Reserve though they made some excavations on the summit and at another place. During 1948 the paths were brought back to their former condition and regularly maintained, four of the shelters were re-built, and new plans of the Reserve placed in each shelter and at the entrance.

The Reserve is threatened on three sides by granite quarries. It is hoped that a limit has now been set to the extent of these quarries, as any further extension will seriously damage this final remaining piece of natural forest in the island. Such an area of forest must be sufficiently large if it is to be self-regenerating, and also if it is to maintain a humid internal climate in which the lesser forest plants can flourish. Ferns and other delicate plants will disappear (some have probably already gone) if the area is further restricted.

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